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An Approach for empirical and dynamic tool for Prediction of Forest Fire Spread Using Remote Sensing and Machine Learning Techniques

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Introduction

- Forest fires are regarded as one of the most pervasive threats in a forested environment. With changing climate induced longer drier spell and higher temperature, wildfires is becoming a major forest disturbances across the world.
- In Australia, 1,34 million ha of total land comprises of forest which consist 3% of global forest area. The flammable Australian ecosystem has a unique combination of topography (mountains divided by long valleys), vegetation (large forest covering), and climatic (scorching summers, gusty winds, extended droughts, and lightning).
- In Australian ecosystems, fires can be managed well with the use of modern advanced technologies and development various forest fire spread models. Additionally, machine learning-enhanced weather forecasting models offer accurate predictions of temperature, humidity, wind, and precipitation, allowing for real-time adjustments in fire management strategies to combat wildfires more effectively.

Aims

- Simulate forest fire spread scenarios by using machine learning.
- To Develop a Empirical and Dynamic Tool for Forest Fire Spread Prediction.

Data Inventory

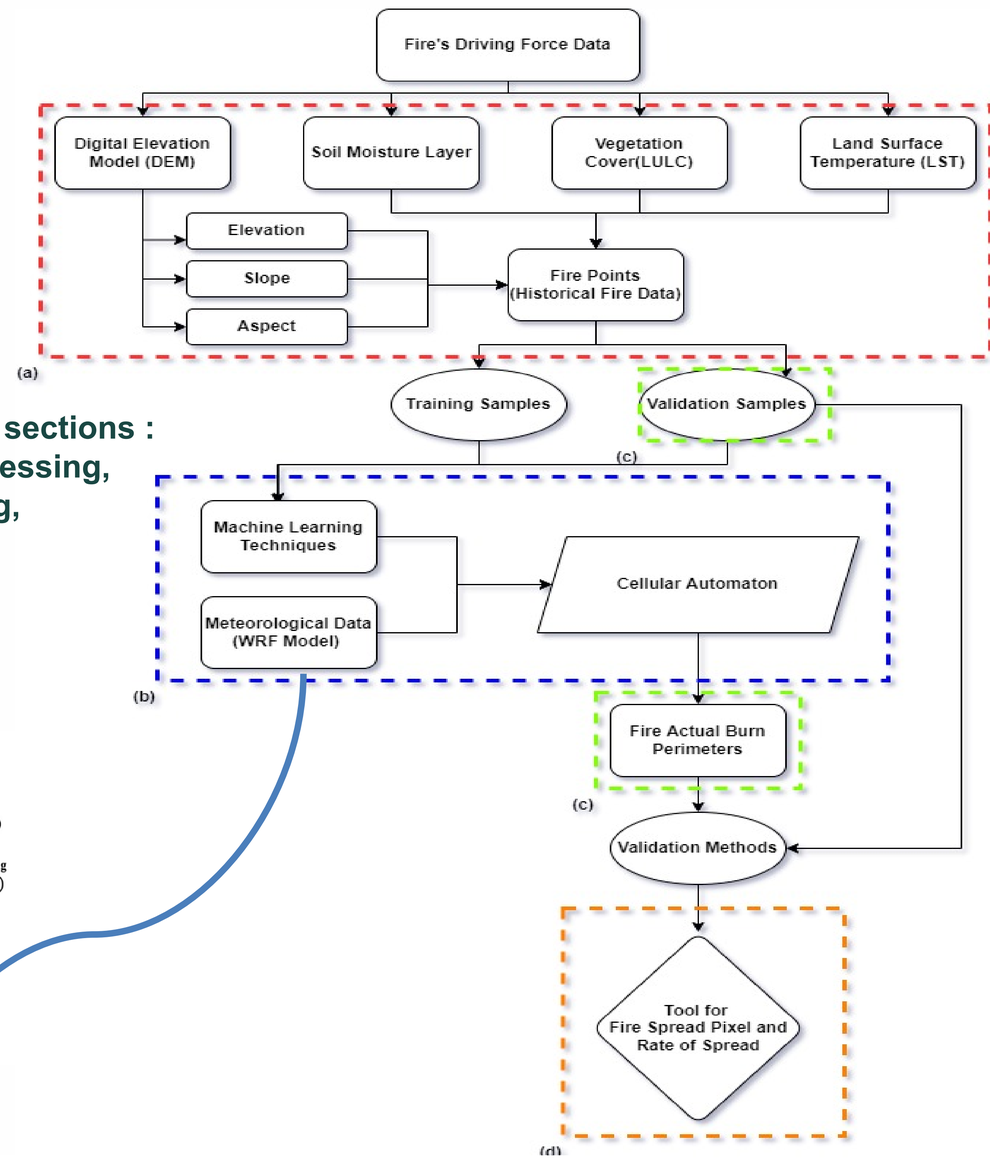
➢Fuel distribution
· Vegetation types and their fire requirements
· Time since last burn
· Fuel accumulation according to vegetation types
· Fuel condition (moisture etc.)
· Fuel continuity (widespread distribution or scattered)

➢ Physical factors
· Topography (elevation, slope, aspect etc.)
· Weather conditions (local fire danger index)

Research Question

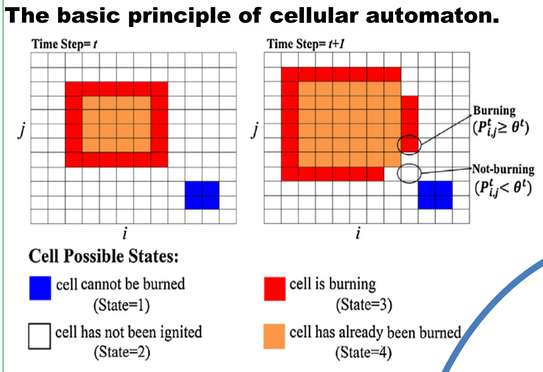
- What is the best Forest fire spread Model for Prediction?
- Which machine Learning algorithms can be used to build a model for forest fire prediction?
- What is the mechanism of forest fire spread and the role of different parameters which influence forest fire spreading?
- How can remote sensing and machine learning techniques be integrated into an effective tool for predicting forest fire?
- What are the best validation approaches for forest fire prediction, and how accurate they are?

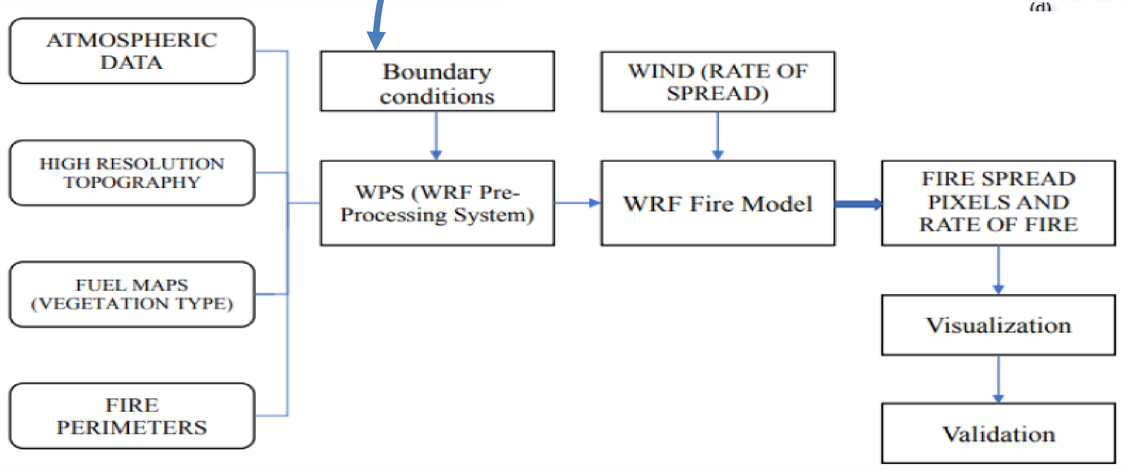
Methodology:



Methodology are divided into 4 sections :
(a) Data collection and pre-processing,
(b) Modelling approach building,
(c) Model validation, and
(d) Tool Development.

The basic principle of cellular automaton.





Expected Result

- Using the Machine Learning, it will use to find that each cell's igniting probability with accurately predicted, as well as the effect of wind velocity on the fire spreading pattern.
- Dynamic GUI Tool for Forest Fire Spread result visualization

References

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- Hogeweg, P. (1988). Cellular Automata as a Paradigm for Ecological Modelling.
- Karafyllidis, I., & Thanailakis, A. (1997a). A model for predicting forest fire spreading using cellular automata. In Ecological Modelling (Vol. 99).

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